Decoding a MODIS-derived landscape map using environmental variables

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CONTEXT

Landscape maps are usually designed using environmental variables and are somewhat subjective. In Bisquert et al. (2013) an objective and reproducible method was proposed for identifying radiometrically homogeneous regions. The hypothesis was that temporal series of Earth Observation images (including vegetation and texture indices) could be used to identify landscape units. Three monthly images (averaged over 2007-2011) of the Enhanced Vegetation Index and the Second Moment texture index were used for performing an object based segmentation, leading to a stratification of the French territory in radiometrically homogeneous regions. **This study analyses the differences between regions in terms of environmental variables to verify the link between these variables and the radiometrically homogeneous regions, and identify those that led to the segmentation.**

OBJECTIVE

To identify the environmental variables that explain better the radiometrically homogeneous regions of France.

DATA

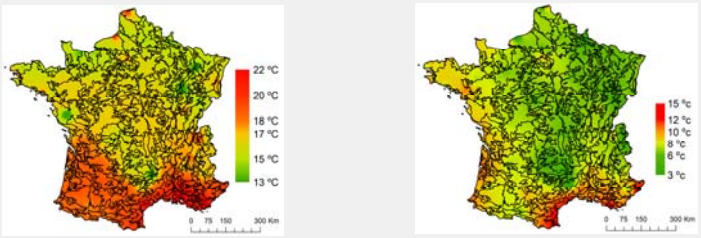
MODIS-based segmentation

292 radiometrically homogeneous regions (Source: Bisquert et al. 2013).

Background image: RBG composition of the EVI monthly images (April, July and December) with a spatial resolution of 250 m.

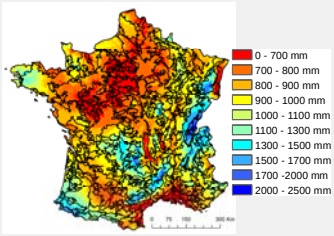
Quantitative environmental variables

Averaged maximum (left) and minimum (right) temperatures over the years 2007-2011



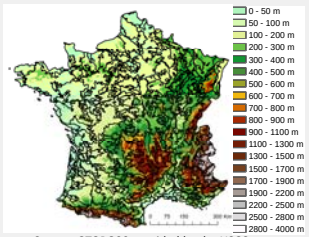
Source: Interpolation of data freely available in the MeteoFrance website

Normal annual cumulated precipitations (1971-2000)



Source: Joly et al. 2010

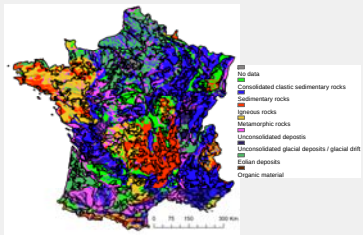
Altitude



Source: GTOPO30 provided by the USGS (United States Geological Survey)

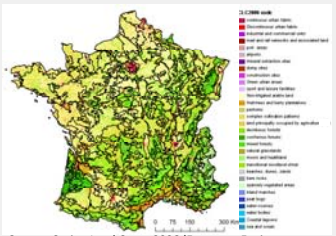
Qualitative environmental variables

Parent material



Source: European Soil Database (ESDB) v2.0 (Van Liedekerke et al., 2012)

Land cover



Source: Corine Land Cover 2006 (European Environment Agency). Derived from Landsat images (30 m)

METHODS

Quantitative variables:

- Average and standard deviation within each segment
- Pearson correlation between averaged variables in each segment
- Moran's Index: spatial autocorrelation between neighbor segments for each variable

Qualitative variables:

- Percentage of occupation of each class in each segment
- Spearman correlation between pairs of neighbor segments

RESULTS

Quantitative variables

Pearson Correlation	Altitude	T_max	T_min
T_max	0.07 (p=0.244)		
T_min	-0.15 (p=0.006)	0.52 (p<0.001)	
Precip	0.15 (p=0.011)	0.06 (p=0.330)	0.14 (p=0.019)

In orange, significative correlations (α=0.05)

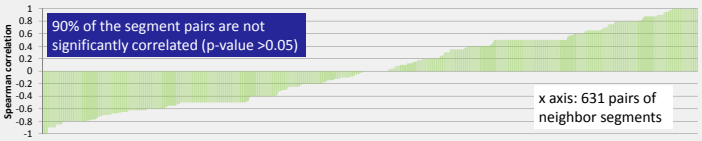
Two possible combinations of uncorrelated variables:
- Altitude and maximum temperature
- Precipitation and maximum temperature

	Altitude	T_max	T_min	Precip
Moran's Index	0.14	0.76	0.46	0.66

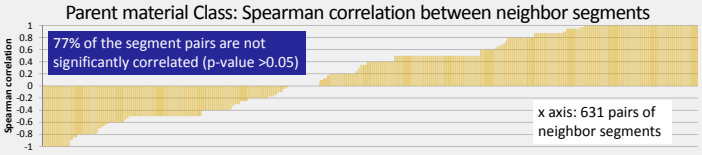
The altitude is the most explanatory quantitative variable of the radiometric homogeneous regions, with the minimum value of Moran's Index (indicating a low autocorrelation between neighbor segments)

Qualitative variables

Corine Land Cover Class: Spearman correlation between neighbor segments:



Parent material Class: Spearman correlation between neighbor segments



The Corine Land Cover is the most explanatory qualitative variable of the radiometric homogeneous regions, with the lowest percentage of correlated pairs of segments

CONCLUSIONS

- The environmental variables showing a lower correlation between neighbor segments are the **land cover** and the **altitude**; the correlation between these two variables should be further analyzed
- The land cover is an important explanatory variable of the radiometrically homogeneous regions obtained by MODIS images. This shows that even at 250 m resolution, MODIS images are able to capture fine land cover mosaics

REFERENCES

Bisquert, M., Bégué, A., Deshayes, M., 2013. A methodology for delineating landscapes at the regional scale using OBIA techniques applied to MODIS time series of vegetation and texture indices. *Remote Sensin of Environment, under review.*

Joly, D., Brossard, T., Cardot, H., Hilal, M., Wavresky, P., 2010. Les types de climats en France, une construction spatiale. Cybergeo: European Journal of Geography (On line), Cartographie, Imagerie, SIG, document 501, on line the 18th June 2010, consulted 23 may 2013. URL: http://cybergeo.revues.org/23155 ; DOI : 10.4000/cybergeo.23155

Van Liedekerke, M. Jones, A., Panagos, P., 2006. ESDBv2 Raster Library- a set of rasters derived from the European Soil Database distribution v2.0 (published by the European Commission and the European Soil Bureau Network, CD-ROM, EUR 19945 EN).

http://tetis.teledetection.fr